

OPERATION AND MAINTENANCE EQUIPMENT AND PROCEDURES

RELEASE NO. 25

July, August and September 1958

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OPERATION AND MAINTENANCE

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INTRODUCTION

This bulletin, published quarterly, is circulated for the benefit of irrigation project operation and maintenance people. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. Reference to a trade name does not constitute the endorsement of a particular product, and omission of any commercially available item does not imply discrimination against any manufacturer. It is hoped that the labor-saving devices or less costly equipment developed by the resourceful water users will be a step toward commercial development of equipment for use on irrigation projects in a continued effort to reduce costs and increase operating efficiency.

Your attention is called to the articles on "Safety" on pages 11 and 21. One article points out that O&M operations experienced a much higher accident frequency rate during 1957 than any other Bureau of Reclamation operation--suggesting that O&M forces should review their activities to assure that all elements of a good safety program are receiving attention. The second article cautions operators in the use of Sodium Chlorate in weed control work. You may also be interested in the short safety reminder on page 12 concerning eye-safety.

In order to insure proper recognition to those individuals whose suggestions are published in this and subsequent bulletins, the suggestion number as well as the person's name is being given. All Bureau offices are reminded to notify their Suggestion Awards Committee when a suggestion is adopted.

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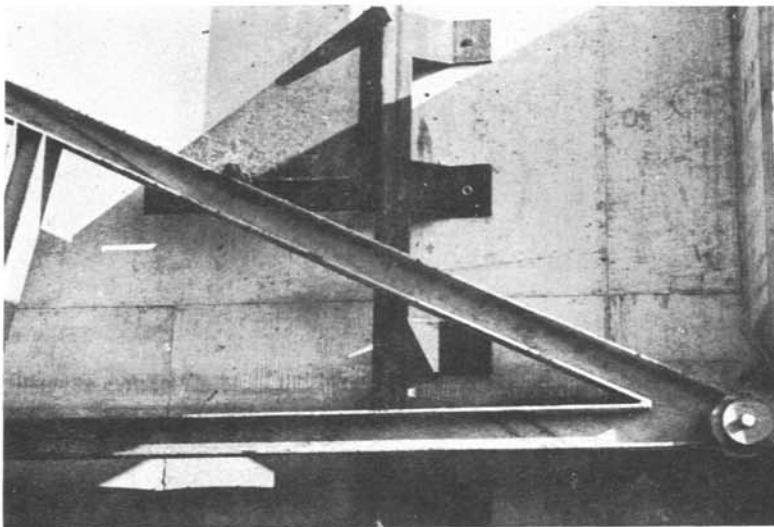
Division of Irrigation Operations
Commissioner's Office
Denver, Colorado

POSITION INDICATORS FOR RADIAL GATES

The need for position indicators on radial gates has been met in a number of ways by operating personnel on our projects. Some of the indicators have simply been marks painted on the wall of the structure and others have been much more complicated. Many of the indicators which have been used with considerable success indicate the radial movement of the gate while others are equipped with mechanisms which record only the vertical component of the gate movement. The latter type have the advantage of indicating directly the relative change in gate opening area while the readings of the indicators of radial movement must be converted to show the actual vertical movement of the gate. It is entirely possible, however, to calibrate the discharge of a gate on the basis of radial movement and a radial scale may be calibrated to show vertical opening.

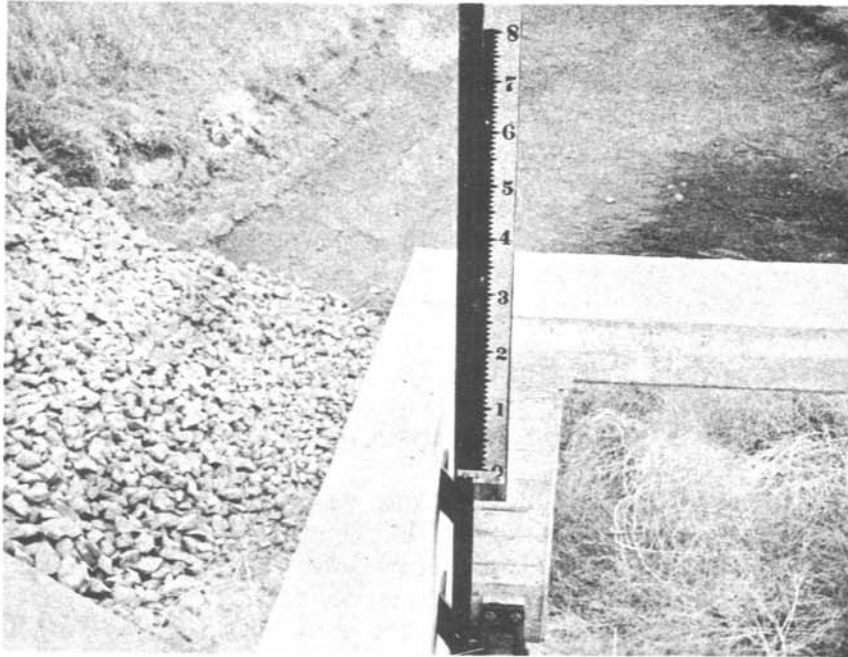
Various studies have been made of position indicating devices with the view of possibly adopting one for installation on all of our radial gates at the time the gates are installed. However, with the varying types and sizes of gates and the different mounting conditions it is apparent that each position indicator would have to be calibrated individually to show vertical movement, and it appeared that too much expense would be involved in trying to accomplish that sort of thing under a construction contract. It was decided, therefore, to let the project operators devise their position indicators according to each one's needs and liking, and as an aid towards that end we are suggesting in this article several different types of devices which have been proven in use.

The first indicating device to be described is one developed on the Bostwick Division, Kansas River Projects, and bears Suggestion No. R7-57-151, submitted by Randall W. Cleveland. This device which records the vertical gate opening, was fabricated and assembled in the project shops from a piece of sheet piling, a piece of plate steel, a $1\frac{1}{4}$ -inch pin and other scraps of metal. The project operators are quite happy with the performance of this device and recommend it to others. Photographs and drawings of this device follow.

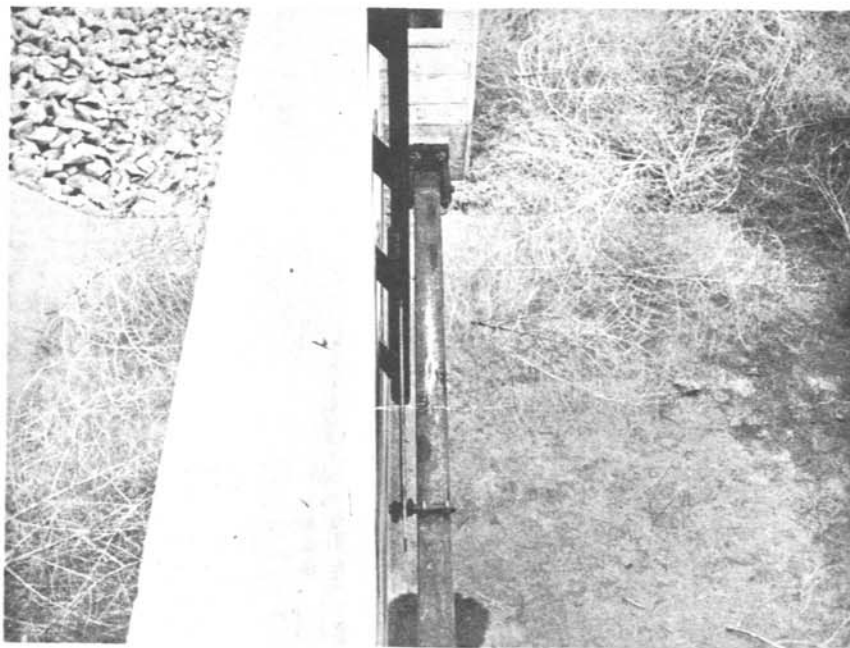


Radial-Gate-Opening Indicator - Courtland Canal - Bostwick Division.

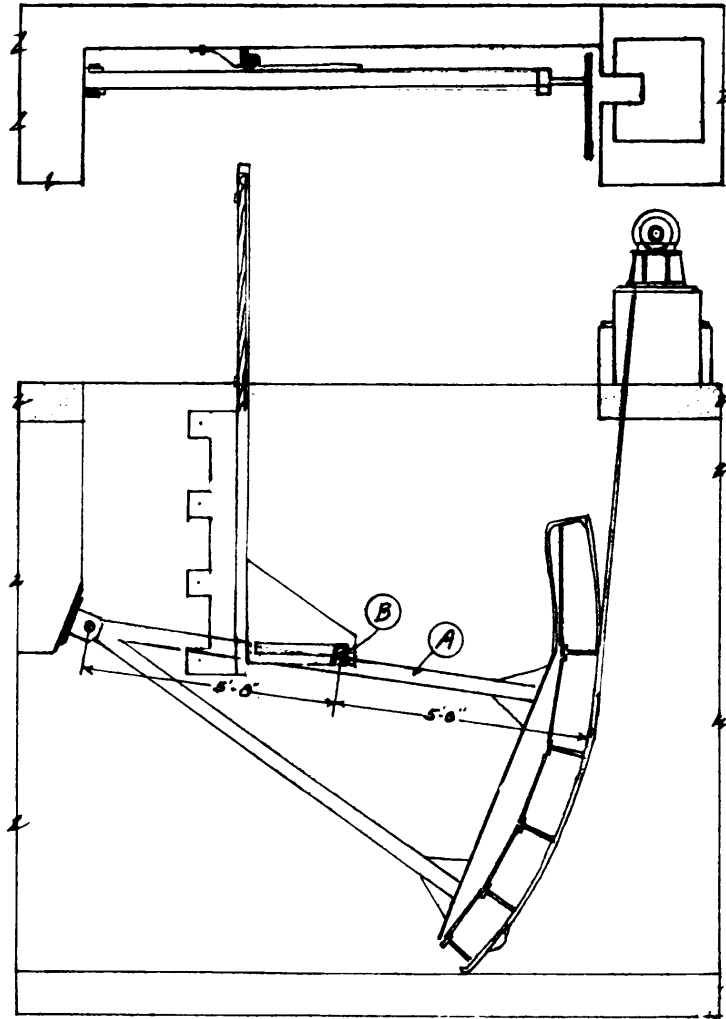
View showing means of attaching the main support (Part No. 1) to the concrete wall. The gate is open about 5 feet.



Radial-Gate-Opening Indicator - Courtland Canal - Bostwick Division. View of painted gage with the gate in the closed position.



Radial-Gate-Opening Indicator - Courtland Canal - Bostwick Division. Overhead view of indicator showing installation of pin and clearance between device and gate arm.

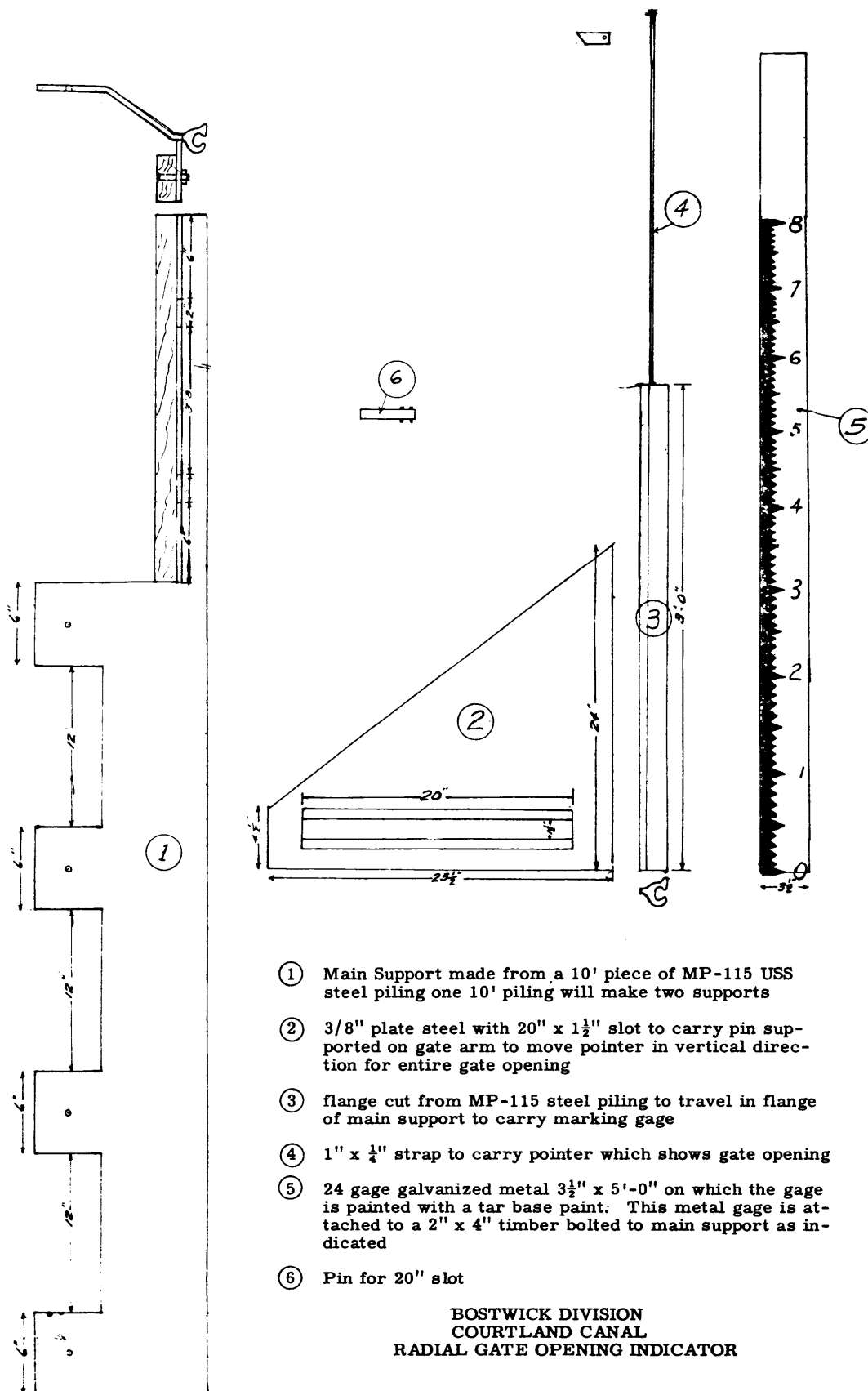


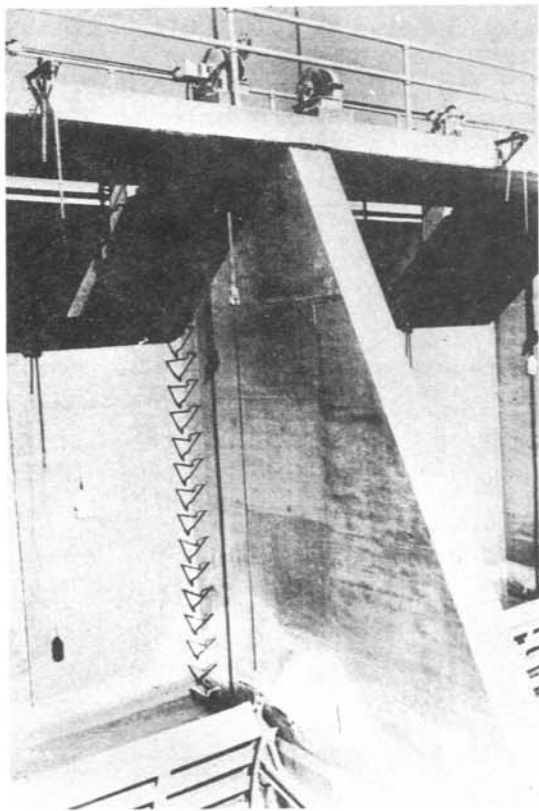
Note

Installation Instructions

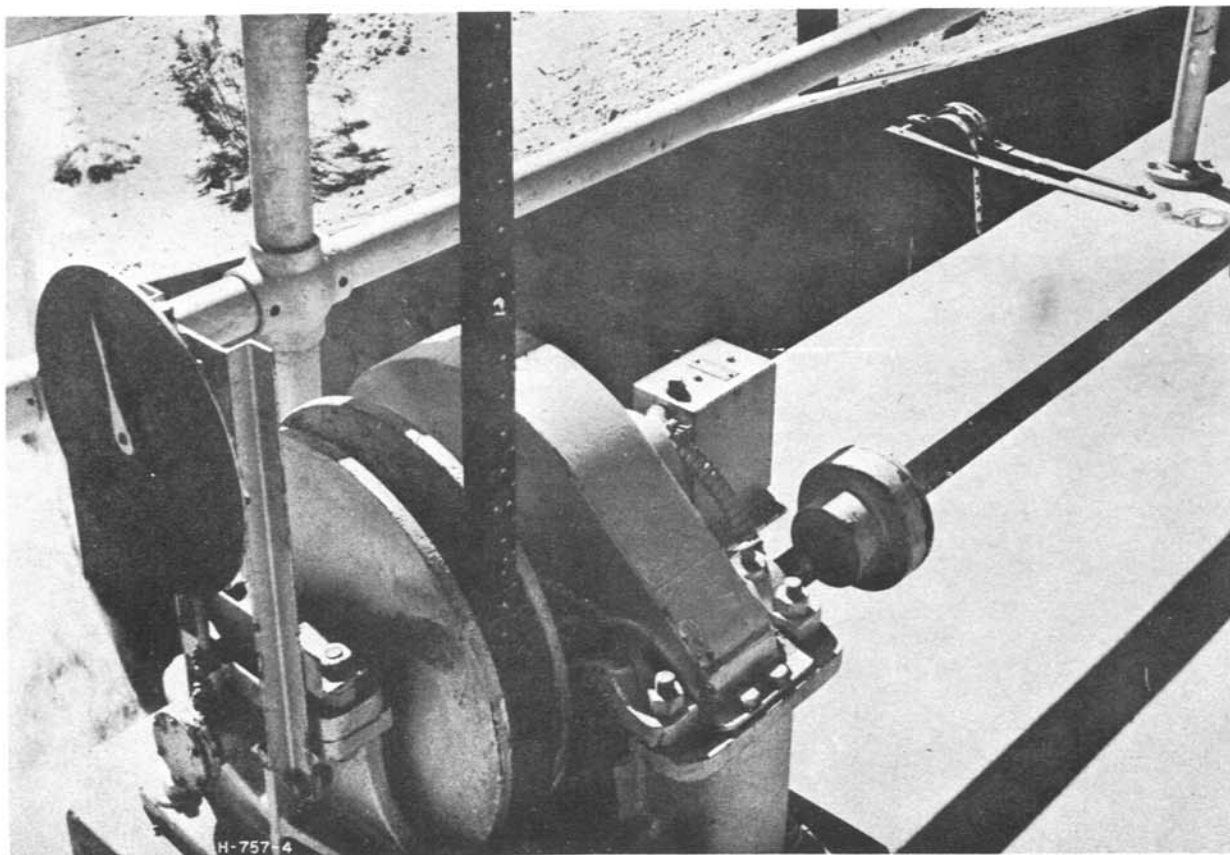
The radial gate arm marked (A) is to be raised to a level position. The $1\frac{1}{4}$ " pin (B) is to be mounted on this arm with U bolts mid-way between the pivot pin of the gate and the face of the gate. The bolt must be at the extreme back of the 20" slot as shown. The remainder of the apparatus to be installed to fit the above conditions. The gauge indicating gate opening should be entirely above the concrete and extend some 4.2' to 4.5' above the concrete.

BOSTWICK DIVISION
COURTLAND CANAL
RADIAL GATE OPENING INDICATOR

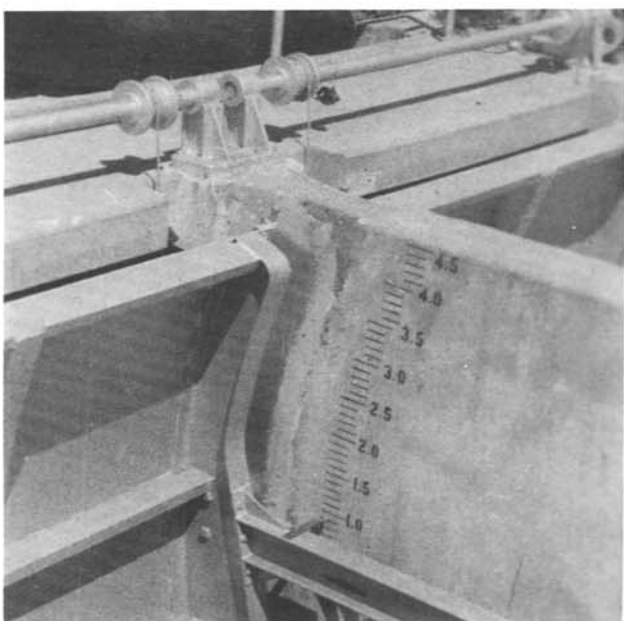
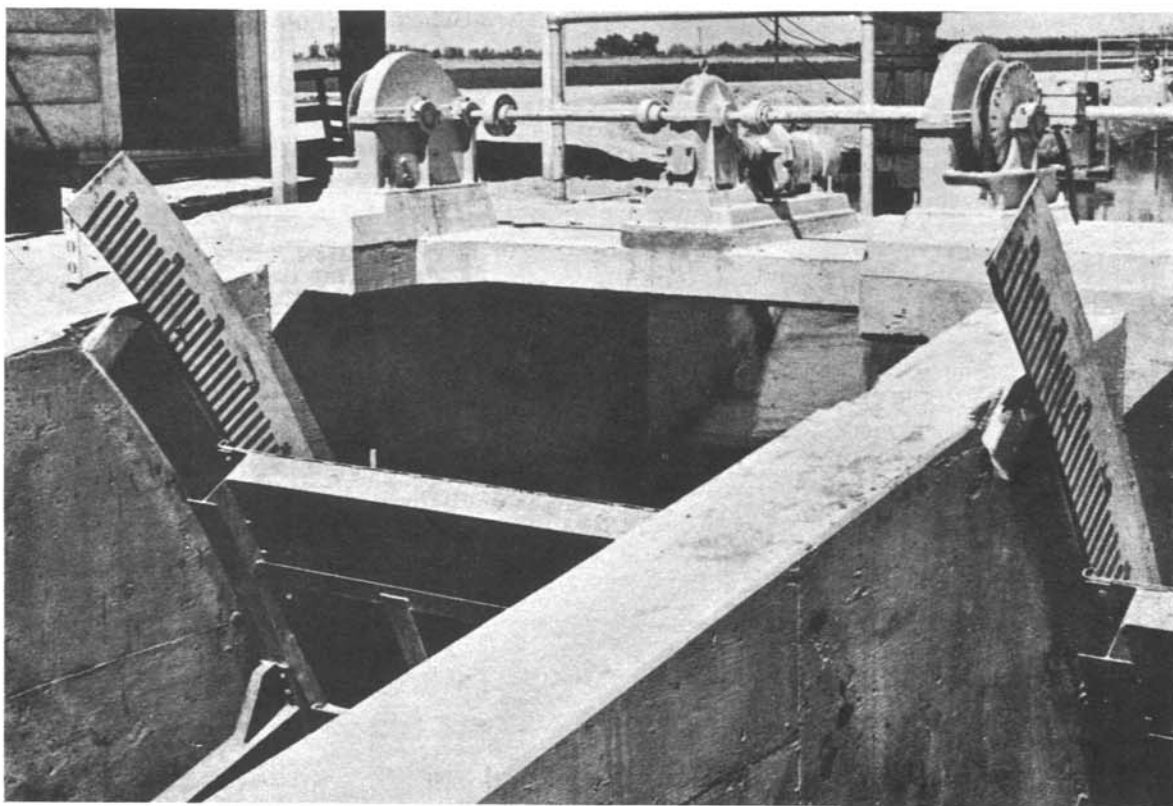




The two photographs on this page are of a position indicator designed for use at Drop No. 1, All-American Canal. As the first photo shows, the operating deck is a considerable height above the top seal gate so that the movement recorded is practically equal to the vertical opening of the gate. In this device a wire is attached to the top of the gate and to the maximum reading end of the flexible tape scale. The tape passes over a pulley at the deck level and has a counterweight attached by wire to its zero end to keep it taut. A pointer is located beside the pulley, in the upper right corner of the lower picture, to indicate zero on the tape when the gate is completely closed and as the gate is raised the amount of opening may be read.



The position indicator here shown is one of the simplest. Plywood strips are calibrated to show radial movement of the gate with the zero mark on the scale set at the top edge of the gate when it is in the closed position. The plywood scales are mounted by anchor bolts to the concrete walls of the structure which is the Wistaria Check on the All-American Canal.



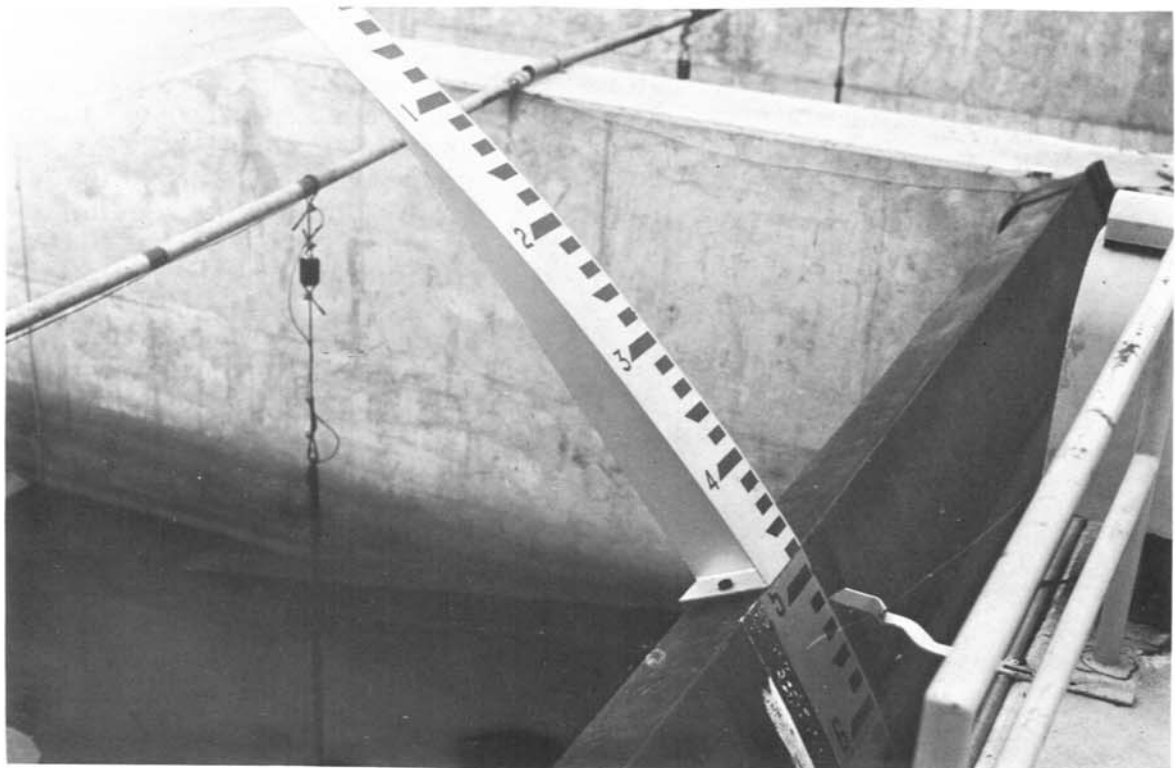
Shown here is another simple device for indicating gate openings. A pointer attached to the top of the gate arm indicates the opening on a scale painted on the wall of the structure. The scale could be extended above the wall on a board, if desired.



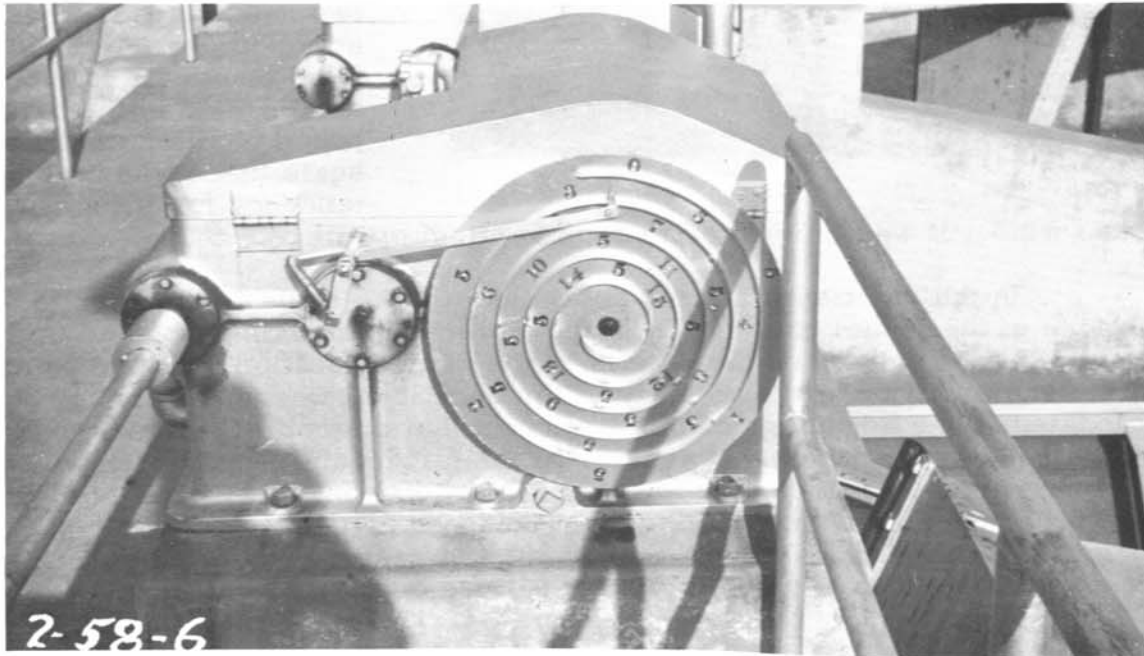
Another type of stationary scale position indicator is shown at left. This device was developed for use on the Delta-Mendota Canal, Central Valley Project, by Mr. Francis Lassell. The scale is installed on the dividing wall between two gates and an adjustable pointer arm extends from each gate to the scale. Due to the exposed position of the scale there was a slight tendency for it to vibrate

in the wind. It was calibrated to read vertical openings.

In the position indicator shown below, the scale is attached to the face of the radial gate and is supported by an extension attached to the top member so that when the gate is in the closed position the zero point on the scale will be approximately at the deck level where the pointer arm is located. One advantage of this device is that a standard enamel gage can be used thus providing a weather proof serviceable gage which will not need repainting. This device indicates the radial opening of the gate, although by special calibration the scale could be made to show vertical openings. Messrs. Icardi and Sturdivant are responsible for the development of this indicator which is in general use on the Delta-Mendota Canal.



It has been found that gate position indicators geared to the gate hoist offer some chances of error, through stretching of hoist ropes, etc., which are not present when the device is attached directly to the gate. However, Region 2 offers two devices which are geared to the gate hoists and which they find to be quite accurate. The first position indicator was developed, and is being used, on the Friant-Kern Canal, Central Valley Project. The foot and half foot positions are marked on the disc which turns with the drum shaft, the helical track carrying the pointer arm. The disc is calibrated to show vertical gate opening.



The 18 radial gates at Nimbus Dam are equipped with revolution counter type position indicators which can readily be seen from the gate hoist operating stations. The counters are connected to the pinion



shaft of the drum unit through spur gears of 52 to 20 teeth so that the digital reading closely represents gate travel to hundredths of a foot. The gates were rated by computations, originally based on gate opening, and converted to relate directly to the indicator readings of these particular gates. Zero indicator reading was made to correspond to the point at which flow starts under the gate. The field reports that the operation and accuracy of the indicators have been excellent since their installation in July 1957.

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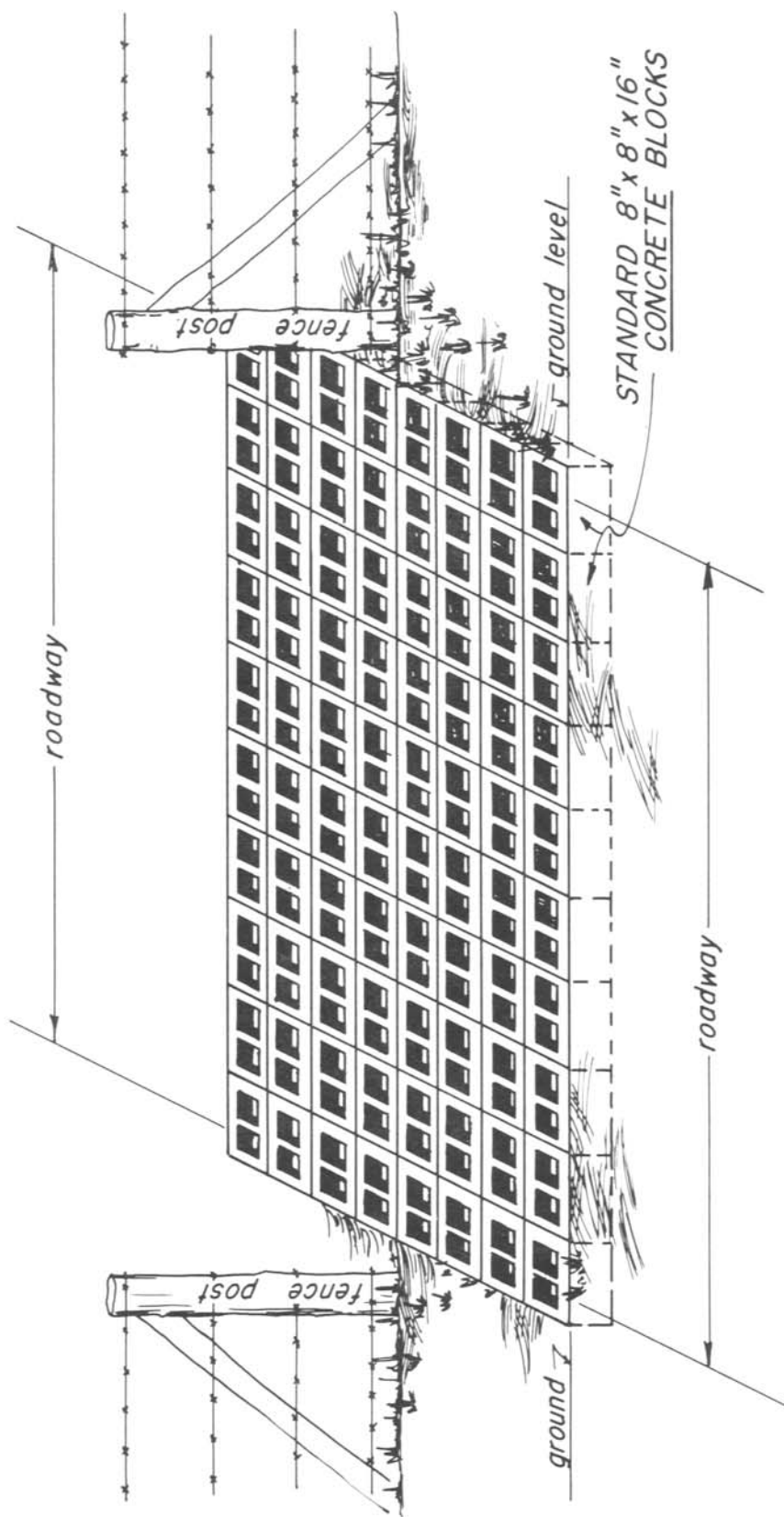
CONCRETE BLOCK CATTLE GUARD (Suggestion NPS3-57-72)

Several installations of the inexpensive yet effective cattle guard similar to the one shown in the photograph below have been made by the U. S. National Park Service at National Monuments in the vicinity of Santa Fe, New Mexico. Generally, the cattle guards have been found to be effective as well as neat in appearance, although a few wise cows have solved the mystery of the guard and seem to be able to occasionally cross it.



The installations have been quite successful and the economy of them has caused them to be attractive for use in locations on roads where traffic is light. The photograph on the following page is another view of the guard shown above as it was used at the entrance to the Southwest Archeological Center.

The proposed cattle guard can be constructed in about one man-day, provided it is not necessary to place it in solid rock. It is constructed by excavating a trench 8 inches deep, 4 feet or wider across the roadway and 10 to 12 feet long for one-way traffic. Standard 8"x8"x16" concrete building blocks are snugly fitted into the trench with the holes of the blocks placed up. It is important that the small end of the holes in the blocks be placed on top to increase the shadow in the hole, as this apparently has some psychological effect upon a cow.



AN INEXPENSIVE CONCRETE BLOCK CATTLE GUARD

SUGGESTION BY MILTON J. MCCOLM
NATIONAL PARK SERVICE 5-24-57



A fence may be terminated in a less expensive structure such as a single braced post, as shown in the drawing on the preceeding page, at each end of the cement block, prepared by the National Park Service to illustrate the installation suggested by Milton J. McCollm of that agency.

The cost of the guard in the Santa Fe, New Mexico, area constructed as shown on the drawing is estimated to not exceed \$100. The cost of the block will vary from \$20 to \$50, depending upon the roadway width.

If further information is desired, write the Director, Region 3, National Park Service, Santa Fe, New Mexico.
(Photographs illustrating the article were taken by Turney)

* * * * *

O&M SAFETY

The safety record of operation and maintenance forces is not outstanding, to say the least, according to the Bureau of Reclamation's publication Safety Record, for the first quarter of 1958. The Record summarizing the accident record of Government Forces for the year 1957, showed that O&M operations had an accident frequency rate of 18.6, which was the highest of the six major categories of work performed by Government Forces. Irrigation operations with 13 percent of the total man-hours accounted for 27 percent of the accidents. The 18.6 rate is over twice the Bureau average of 9.1 for the year 1957. However, it is 5.2 points lower than the 23.8 rate experienced in 1956.

Quoting from the Record, it is suggested that O&M forces:

" . . . should review their activities to insure that all elements of their accident prevention program are receiving full attention. "

The Record lists the elements that make up the Bureau's basic safety program as follows:

Design safe plant facilities and equipment

Conduct periodic safety inspections

Physical plant and equipment

Work operations

Correct unsafe conditions and deficiencies found

Hold safety meetings regularly

For supervisors

For crew members

Maintain active safety committees

Of supervisors

Of workmen

Supervisors active participation in

Safety education

Training of crew members

Stress and maintain

Advance planning of work by supervisors

Standardization of work operations

Use of personal protective equipment

Preventative maintenance system on all mechanical equipment

The Record reminds us that "neglect to follow some basic part (of the outlined program) or to enforce safety methods aggressively would have made the difference in (the accident record) in many cases. In effect accidents are the result of our mistakes and errors that produce injuries or equipment damage. The word 'safety' should not be thought of as restricting or limiting our work activities; but rather where followed produces an active aggressive attitude in going about our daily work. It helps to chart a course that will produce a minimum number of errors. Essentially that is what we are trying to accomplish by our safety efforts."

FROM THE RECORD IT LOOKS LIKE WE COULD IMPROVE OUR SAFETY PRACTICES. LET'S SEE WHAT WE CAN DO.

* * * * *

FIVE SENSE WORTH

(Also borrowed from the Bureau's above quoted Safety Record)

Someone with a yen for mathematics has figured out that to earn your living, you depend on your eyesight six times as much as your other four senses combined. Of course, if you are a piano tuner, a tea taster, or a perfume sampler it might be different. But for the average person the relative value of your senses is as follows: Eyesight--87%,

Hearing--7%, Smell--3.5%, Touch--1.5%, Taste--1%. If you are on an eye-hazardous job, at the shop or at home, you can't afford to gamble your eyesight. Wear eye protective equipment because it is smart to do so. Remember:

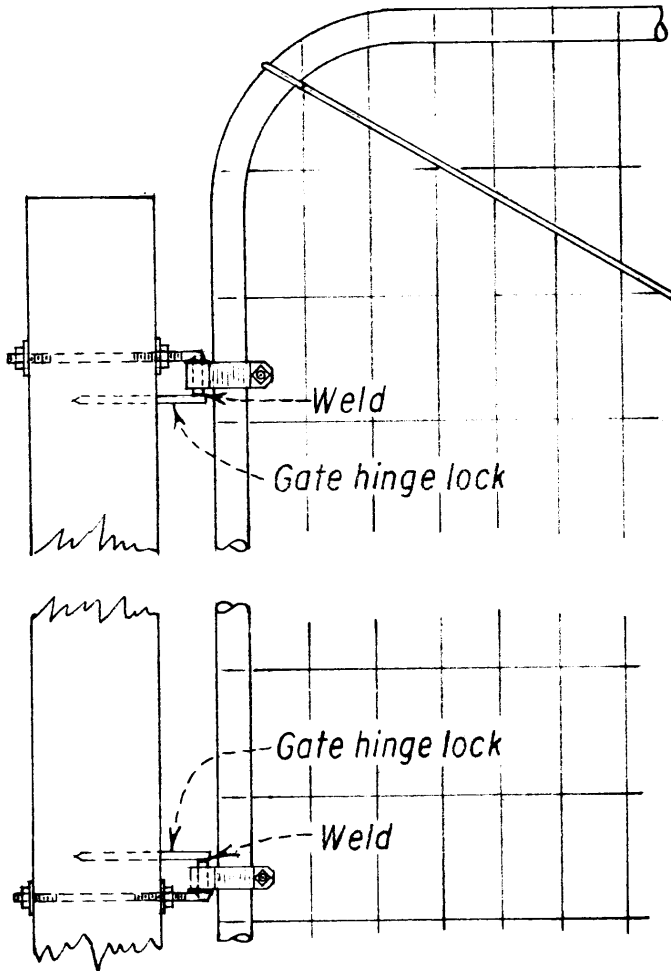
You can walk on an artificial leg.
You can eat with an artificial hand.
But you can't see out of an artificial eye!

* * * * *

HINGE LOCK FOR GATES (Suggestion R2-58-69)

Unauthorized entry to the rights-of-way for canals in the Central Valley Project, California, is prevented by each gate on the canals being secured with a penalty lock. The project has experienced some difficulty,

however, with unauthorized persons lifting the gates off the hinge bolts to gain access. The locking device suggested by Owen J. Stearns, Canal Maintenceman, Fresno Operations Branch of the project, shown at left has eliminated this problem.



The lock is used on gates of the Friant-Kern and Madera Canals. The lock consists of a 3/8- or 1/2-inch diameter steel rod driven about 3 inches into the wooden post supporting the gate. The rod is then welded to the upright lug of the hook bolt which supports the gate hinge. The hinge bolt is prevented from turning, the gate hinge from being displaced, and consequently, the gate cannot be lifted from the hinge bolt.

* * * * *

DISPOSAL OF USED MOTOR OIL (Suggestion R2-58-195)



The device used to collect, store and dispose of used oil drained from motor vehicles, and shown at left, is a suggestion of William Cottriel of the Cachuma Project, Oak View, California.

The handy multi-purpose device was fabricated from a commercial lubricant drum, a base equipped with casters, several pieces of standard size pipe and fittings, and a shop constructed metal pan. A standard hand-operated barrel pump to which a 3-foot length of small diameter hose has been connected, and a nozzle complete the unit.

Oil is collected and stored in the drum until it is filled and must be disposed of. The oil is used to spray weeds or gravelled surfaces in the vicinity of the project shops to keep down the dust. The base which is fitted with casters carries the unit easily over hard surfaces.

* * * * *

WIRE ROPE GUARD ON CHECK STRUCTURES



The wire rope installed on the check inlet chute at Station 1490 on the Wyoming Canal, Riverton Project, Wyoming, was provided as a safety measure. In handling stop planks a man may grab the wire rope, if necessary, but the space required to handle the planks is unobstructed.

A center post is to be provided to lend more stability to the wire rope.

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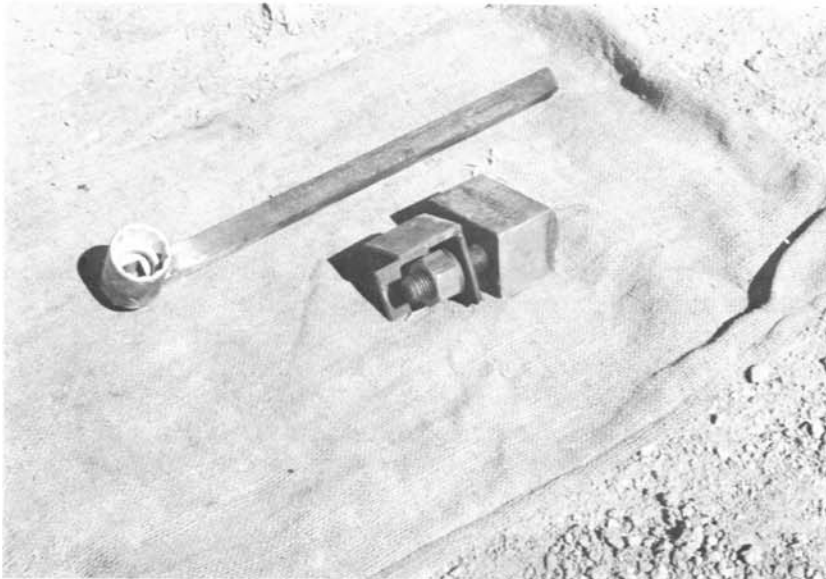
LOCKING DEVICE FOR GEAR TYPE SCREW GATES (Suggestion R5RG-58-5)

A steel block bolted to the base of a screw gate as shown below was suggested by Henry C. Lange, Ysleta Field Branch of the Rio Grande Project in New Mexico and Texas, as a means of locking gear type screw gates to prevent tampering by unauthorized persons.



Fitting the steel block between the spokes of the gear wheel prevents the gear, which operates the stem, from turning.

A 3/4-inch bolt was used, but it can be almost any size. The bolt nut is fitted into a steel shell through which the bolt passes so that only a socket wrench can be used to turn the nut. In the case shown, the shell was enclosed on two sides only since the base of the gate formed a closure on the other two sides. However, the shell or cup can be four sided or circular. The essential parts are shown in the lower photograph. The bolt is spot welded to the steel block.



To remove the block it is necessary to have a socket wrench generally not available to everyone. The device replaces chains and locks which have not been satisfactory

in preventing unauthorized people from operating wasteway gates.

* * * * *

MINIDOKA ONE-MAN DITCHER

Since the beginning of mechanized maintenance of irrigation works, O&M people have been seeking a more efficient means of ditch cleaning. An approach to the problem on the Minidoka Project, Idaho, has been the construction, in the project shops, of the machine shown below for use in cleaning small to medium sized canals, laterals and surface drains.



The ditcher can construct or clean flat bottom ditches in natural ground that are 2-feet deep, have a base width of 30 inches and 1-1/2:1 side slopes. The machine has a 10-foot wing spread and will elevate the excavated material up to 4 feet on each bank. The ditcher, as shown in more detail in the photograph on the following page, mounts on an adjustable tool bar (a converted dozer frame) on the rear of a D-7 Caterpillar tractor. It is operated by cable and controlled by one man. The ditcher can be maneuvered to within 6-inches of certain structures and is moved about the project on a low-bed trailer.

Construction details of the ditcher are given in the drawing on the following page, which was prepared by Elmer Casad, a retired Bureau employee, Rupert, Idaho.

The machine, pictured on page 16 and below was designed and constructed by Bureau personnel in the Bureau's North Side Irrigation



Field Division shop at a total cost of \$2,500. The machine is now in use on the Minidoka Project and is estimated to have provided a savings of \$6,000 in one year's time in cleaning surface drains alone. In addition to this savings, because of the versatility of the ditcher, the project was able to clean more miles of ditch than would otherwise have been possible. A second machine is now being constructed and

will be in operation in the fall of 1958.

* * * * *

SPRAY RIG GASKET

A section of 1-1/4-inch O. D. discarded spray hose makes an excellent gasket to prevent spillage around the filler opening of a bean spray rig. This is the practical way Eugene G. Cakin, Tracy, California, solved the problem of weed oil slopping out around the cap of the filler opening and creating a mess of the rig and the bed of the pick-up truck used in the spraying of weeds on the Central Valley Project.



* * * * *

GROUND ROD DRIVER AND PULLER (Suggestion R2-58-224)

Driving and pulling a ground rod, driven to a depth of five or six feet into hard pan, can be an exasperating and unsafe operation.



The puller and driver devised by Weston E. Briggs, Central Valley Project, Folsom, California, simplifies the operation.

Constructed as shown for the pulling and driving of 5/8-inch rods, a similar device constructed for the pulling of other rods, stakes, metal fence posts, etc., is a convenient

piece of equipment to have available.



Basically, the unit shown consists of a lever with the fulcrum near the end and a gripping device cinch slips over the ground rod and cinches up securely with a shearing action when upward force is applied. The gripping part of the device consists of two pieces of steel plate drilled with a hole slightly larger than the diameter of the ground rod. The top plate is flat 1/2-inch steel. The bottom 5/8-inch plate is tapered to 1/2 inch on the outside end so that when it is forced up against the upper plate it creates a shearing action and makes a positive grip on the rod. The plates are slotted and mounted on a ring which in turn is fastened through another ring on the lever. The gripping

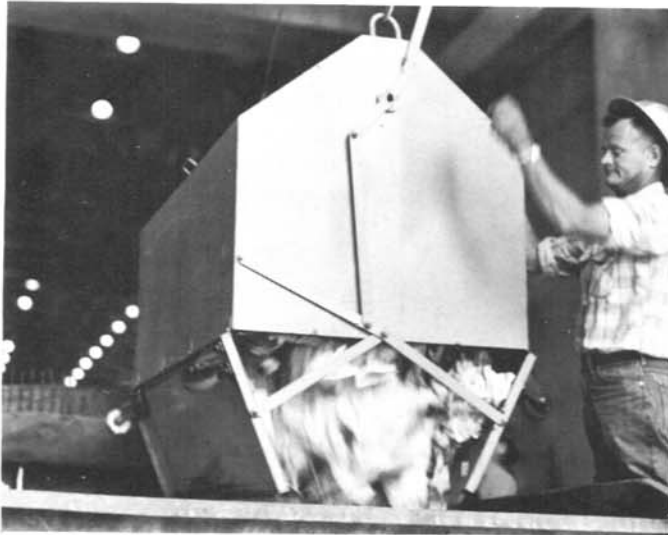
action is released when the upward pull is relaxed, making it possible to "jack" the rod out of the ground.

The rod driver is a piece of pipe with a weighted end.

* * * * *

KING SIZE REFUSE CONTAINERS (Suggestion R2-58-208)

Bottom dumping, fireproof containers in use at Shasta Dam and Powerplant, Central Valley Project, California, simplify the handling of refuse and have the added sanitary advantage of eliminating the manual handling of the refuse.



Developed by H. C. Van Dolah, the containers are of sufficient capacity to hold all trash and refuse accumulating in the area between the twice-a-week pick-up and disposal periods.

As shown, the bottom dumping also simplifies the handling of the containers with a small crane and their dumping. Rollers on the bottom of the containers provide an added convenience in movement to desired locations.

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SHASTA TROLLEY SCAFFOLD (Suggestion R2-58-209)



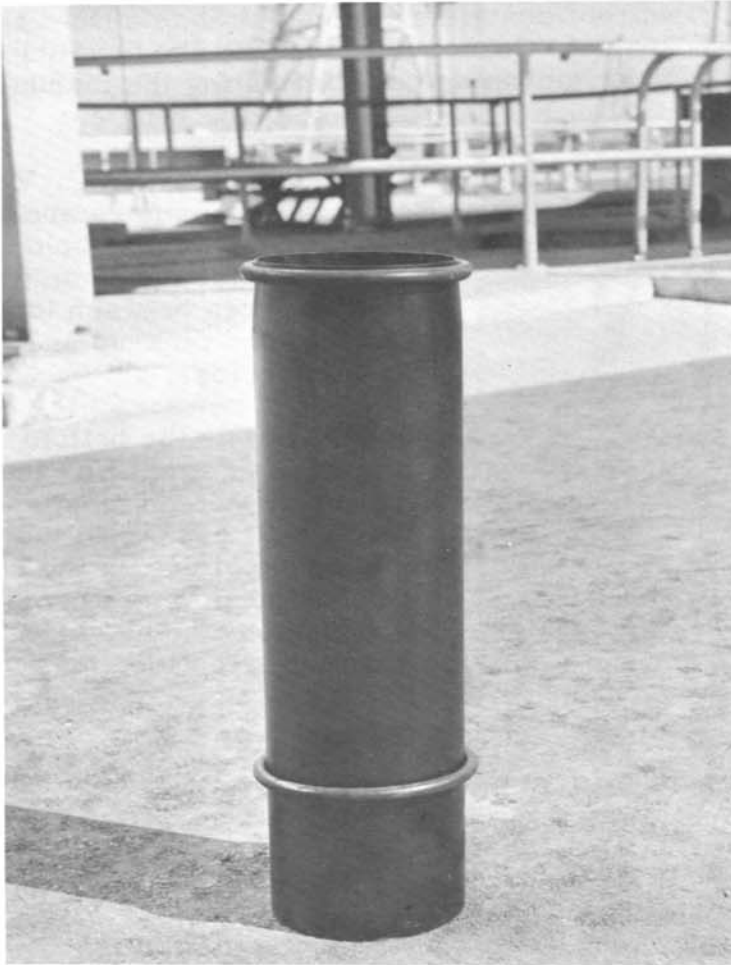
When it was decided that flood lighting was to be installed at Shasta Dam, two employees suggested the trolley scaffold pictured at left and on the cover of this issue of the Bulletin. The excellent ideas of O. E. Stapleton and Troy Wolverton saved the Bureau \$2,500 in direct savings and provided a much safer operation.

The photographs present general views of the scaffold, but if construction details are

desired, write the Director, Region 2, U. S. Bureau of Reclamation, Sacramento, California.

* * * * *

RUBBER RINGS REDUCE PIPE REPAIR COSTS (Suggestion R2-58-172)



Where the inside of a broken sump pipe is accessible from the sump, a smaller diameter pipe with tapered end and fitted with rubber rings, as shown in the photograph at left, can be used to make a quick and inexpensive repair job.

This particular method of repair, suggested by Gilbert C. Ricioli, and used by the Tracy Operations Office of the Central Valley Project, Tracy, California, avoided removal and replacement of about 60 square feet of concrete.

The slight reduction in the size of the pipe did not materially affect the pump operation in this case.

* * * * *

SODIUM CHLORATE AND SAFETY

The use of sodium chlorate as a weed control material is not generally recommended because of its dermatitis and fire hazard problems. If used, sodium chlorate and other chlorate weed-killing compounds should be handled with extreme caution. The following precautions should be rigidly observed:

1. Sodium chlorate should not be permitted to come into contact with the skin or the eyes. If it gets on the skin or in the eyes, the chemical must be removed immediately by thoroughly flushing the surfaces with water.

2. Sodium chlorate should be stored in tightly covered metal containers. The containers should never be opened in buildings; or placed in fields where there is any livestock.
3. Should sodium chlorate be spilled on the clothing, such clothing, since it constitutes a dangerous fire hazard when dry, should immediately be removed and thoroughly washed. Rubber boots and gloves should be worn by workmen when spraying with the chemical.
4. A person should not be permitted to walk or ride, or to move equipment of any kind through treated areas, and livestock should be kept out of such areas until after a heavy rain, as even slight friction is likely to ignite the vegetation and cause serious fire damage. Areas near buildings where fires might result in loss of life or property should not be sprayed. Smoking should be prohibited while applying sodium chlorate or while working around sodium chlorate containers, equipment, or treated areas.

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